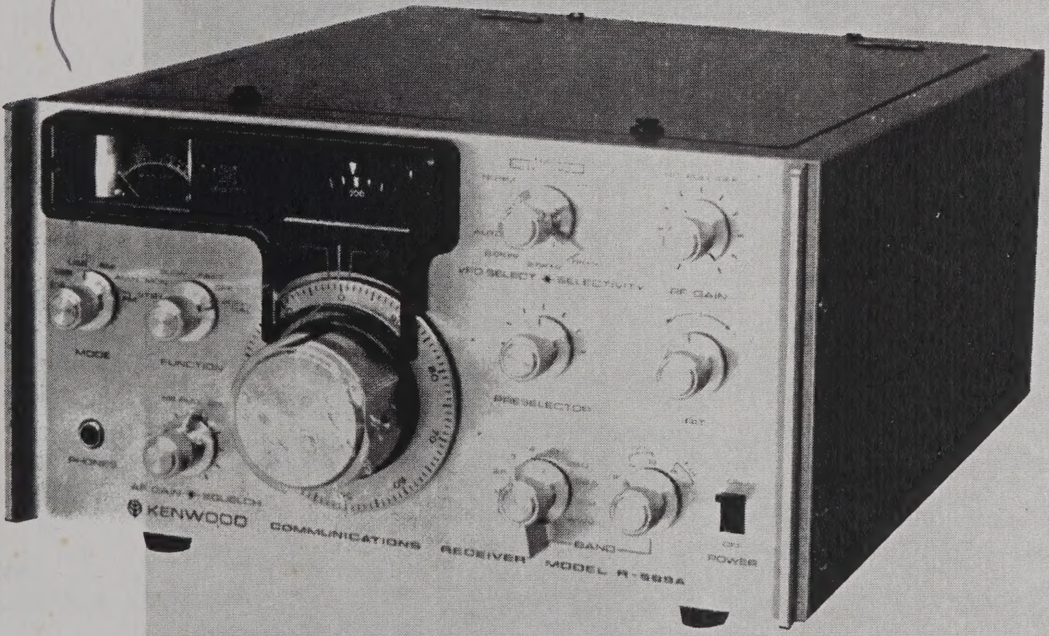
KENWOOD

Model R-599A

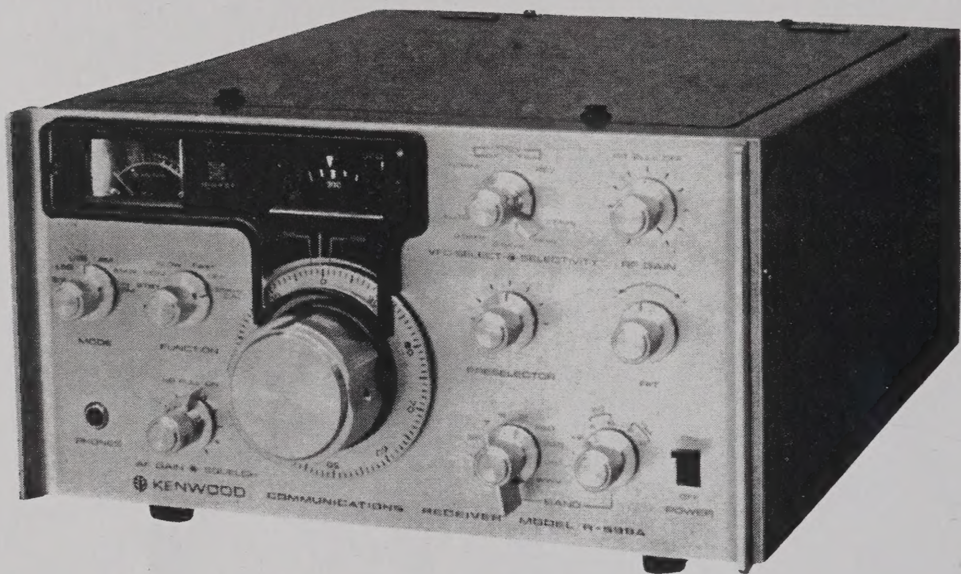


OPERATING MANUAL

KENWOOD®

COMMUNICATIONS RECEIVER

Model R-599A



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KENWOOD R-599A SPECIFICATIONS

FREQUENCY RANGE:	1.8 MHz Band — 1.8 to 2.3 MHz. 3.5 MHz Band — 3.5 to 4.0 MHz. 7.0 MHz Band — 7.0 to 7.5 MHz. 14.0 MHz Band — 14.0 to 14.5 MHz. 21.0 MHz Band — 21.0 to 21.5 MHz. 28.0 MHz Band — 28.0 to 28.5 MHz. 28.5 MHz Band — 28.5 to 29.1 MHz. 29.1 MHz Band — 29.1 to 29.7 MHz. CB Band — 26.8 to 27.4 MHz. 50.0 MHz Band — 50.0 to 53.4 MHz (with accessory converter). 144.0 MHz Band — 144.0 to 147.4 MHz (with accessory converter). WWV — 10.0 MHz.
MODE:	LSB, USB, CW, AM, and FM.
POWER REQUIREMENTS:	100/117/200/240 VAC, 50/60 Hz. 12 - 15 VDC.
POWER CONSUMPTION:	Less than 15 watts.
AUDIO OUTPUT IMPEDANCE:	4 to 16 ohms for speaker or headphones.
AUDIO OUTPUT:	More than one watt (with less than 10% distortion) into an 8 ohm load.
ANTENNA INPUT IMPEDANCE:	50 to 75 ohms (unbalanced).
FREQUENCY STABILITY:	Within 100 Hz during any 30 minute period after warmup. Within ±2 KHz during the first hour after warmup.
CALIBRATION ACCURACY:	Within 2 KHz across the frequency range after calibration at zero.
BACKLASH:	Not more than 400 Hz when the dial is advanced from 0 to 600 and returned to zero.
FREQUENCY READOUT:	Complete to 1 KHz calibrations on the dial scale.
IMAGE RATIO:	Better than 50 db down when compared to 1 μv.
IF INTERFERENCE:	Better than 50 db down when compared to 1 μv.
SENSITIVITY: *	SSB — 1.8 through 28 MHz Bands — Better than 0.5 μv. CB Band — Better than 0.5 μv. 50 MHz Band — Better than 1.0 μv (with accessory converter). 144 MHz Band — Better than 1.0 μv (with accessory converter). WWV Band — Better than 0.5 μv. AM — 1.8 through 28 MHz Bands — Better than 3.0 μv. CB Band — Better than 3.0 μv. 50 MHz Band — Better than 6.0 μv (with accessory converter). 144 MHz Band — Better than 6.0 μv (with accessory converter). WWV Band — Better than 3.0 μv.
SELECTIVITY:	SSB: Better than 2.4 KHz bandwidth (6 db down). Better than 4.4 KHz bandwidth (60 db down). CW: Better than 500 Hz bandwidth (6 db down). Better than 1.5 KHz bandwidth (60 db down). AM: Better than 5 KHz bandwidth (6 db down). Better than 12 KHz bandwidth (60 db down). FM: Better than 20 KHz bandwidth (6 db down). Better than 120 KHz bandwidth (40 db down).
AGC:	Selectable automatic gain control for fast, slow, or no AGC.
SQUELCH:	Built-in squelch.
VFO VERSATILITY:	Versatile cross channel operation with T-599A transmitter.
FIXED FREQUENCY OPERATION:	Built-in fixed frequency oscillator for single channel operation.
CALIBRATOR:	Built-in 25 KHz crystal oscillator.
RIT:	The receiver incremental tuning control can vary the receive frequency ±2 KHz or more.
METERING:	Built-in S-meter S1 through S9 to 80 db over.
SEMICONDUCTOR COMPLEMENT:	8 FET. 2 IC. 30 transistors. 51 diodes. 2 zener dioodes. 1 variable capacity diode.
DIMENSIONS:	10.125″ wide x 5.50″ high x 12.25″ deep.
WEIGHT:	12.5 pounds. 21.5 pounds shipping weight.

* [All with a 10 db (signal + noise) / noise ratio].

SECTION 1 INTRODUCTION

1.1 KENWOOD R-599A

The R-599A is a modern, sophisticated solid state amateur radio receiver. Operating on all amateur bands between 1.8 and 30 MHz, as well as the CB band and WWV at 10 MHz, this unit is constructed modularly. All major electronic circuits are wired on easily removed or installed circuit boards. The R-599A includes many built-in features usually found as extras on other receivers. Included in the equipment are a 25 KHz crystal calibrator, an RIT circuit, and a squelch. The R-599A also includes automatic gain control (AGC), 1 KHz frequency readout, fixed frequency operation, an effective noise blanker, and versatile operation with the matching T-599A transmitter.

1.2 REQUIREMENTS FOR OPERATION

AC OPERATION

The R-599A requires no external power supply for operation. For fixed station operation, the R-599A operates from any 120/240 VAC, 50/60 Hz power source capable of supplying 15 watts or more.

DC OPERATION

The R-599A will operate directly from any 12 VDC power source. It draws about 15 watts.

EXTERNAL SPEAKER AND HEADPHONES

Receiver audio output from the R-599A is 1 watt at 4 to 16 ohms. The S-599 is a matching speaker designed for use with the R-599A. However, if a different speaker is desired, simply connect it to the SPEAKER terminals on the rear panel. The speaker may be any good 4 to 16 ohm permanent magnet type in the 4 inch or larger size.

Headphones should also be 8 ohms impedance. When the headphones are connected to the front panel PHONES jack the speaker is disabled.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the R-599A from its shipping box and packing material and examine it for visible damage. If the equipment has been damaged in shipment, save the box and packing material and notify the transportation company immediately. It is a good idea to save the box and packing material in any case because they are very useful for shipping or moving the equipment.

The following accessories should be included with the receiver.

1 Operating Manual	1 16-pin REMOTE plug
1 Warranty Card	2 Plastic Extension Feet
1 DC 2-pin connector	

The REMOTE connector cord is included with the T-599A

2.2 OPERATING LOCATION

As with any solid state electronic equipment the R-599A should be kept free from extremes of heat and humidity. Choose an operating location that is dry and cool, and avoid operating the receiver in direct sunlight.

2.3 CABLING

ANTENNA

Connect a 50 ohm antenna feedline to the coaxial connector on the rear panel. If a single antenna is desired when the R-599A is used with the T-599A, connect the R-599A's HF ANT connect to the RX ANT jack of the transmitter.

POWER CORD

Make sure the POWER switch on the front panel of the R-599A is turned off, and that the switch (VOLTAGE SELECTOR) on the back of the R-599A is switched to the correct line voltage (120 or 240). Connect the power cord to a power source. If DC operation is desired set the AC/DC switch to the DC position.

SPEAKER

Connect a speaker to the SPEAKER terminals on the back of the R-599A.

REMOTE CONNECTOR

Connect the REMOTE plug per Figure 2 if operation with a transmitter is desired. If the R-599A is used with the T-599A, connect the T-599A's REMOTE cord to the receiver's REMOTE connector.

SECTION 3 OPERATING CONTROLS

3.1 FRONT PANEL CONTROLS

MAIN BAND SWITCH (1 on Figure 3)

This 10-position rotary band switch selects all the necessary circuits to tune the receiver to the desired 600 kHz band (1.8 through 29.1 MHz, CB band, and WWV at 10 MHz).

AUXILIARY BAND SWITCH (2 on Figure 3)

This 5-position rotary switch selects either HF or VHF operation. With the switch set to HF, the main BAND switch selects the desired frequency range. When the switch is set to 50A or 50B, the accessory 6 meter converter is switched to the input of the receiver (see converter instruction sheet). When the switch is set to 144A or 144B, the accessory 2 meter converter is switched to the input of the receiver (see converter instruction sheet).

POWER SWITCH (3 on Figure 3)

This lever switch turns all the circuits of the receiver on or off.

RIT (Receiver Incremental Tuning) CONTROL
(4 on Figure 3)

This variable resistor allows fine tuning of the receiver when the R-599A is operated in the transceive mode with the T-599A. The RIT circuit is turned on and off with the RF GAIN, RIT PULL OFF switch.

PRESELECTOR (5 on Figure 3)

The PRESELECTOR tunes the RF amplifier for maximum gain and selectivity at the desired operating frequency. This control should be adjusted for a maximum S-meter reading at the desired receiving frequency.

RF GAIN, RIT PULL OFF CONTROL (6 on Figure 3)

Turn the RF GAIN control clockwise to increase the RF gain of the receiver. When the control is pushed in, the RIT circuits are turned on. When the switch is pulled out the RIT circuits are turned off.

VFO SELECT — SELECTIVITY CONTROL
(7 and 8 on Figure 3)

This double rotary switch selects VFO function for R-599A - T-599A transceive operation and selects the crystal filter used for reception.

The VFO SELECT switch, a four-position rotary switch, is the inner knob, closest to the front panel section of the control. The switch selects which VFO (the R-599A or T-599A) controls operation when the transmitter and receiver are operated together. Table 1 describes the function of the switch.

TABLE 1

R-599A VFO Select Switch	Receiving VFO	Transmitting VFO
NORM	R-599A	T-599A
RX	R-599A	R-599A
TX	T-599A	T-599A
REV	T-599A	R-599A

When the R-599A is operated alone the VFO SELECT switch must be in the NORM position.

The SELECTIVITY switch is a 5-position rotary switch forms the outer, farthest from the front panel, section of the control. When the switch is set to AUTO the receiver chooses the correct filter for each mode. However, the operator can manually choose whichever selectivity he desires. Table 2 shows which filter is designed for which mode.

TABLE 2

MODE	FILTER
LSB or USB	2.5 KHz
CW	0.5 KHz
AM, AM. N	5.0 KHz
FM	25 KHz

SQUELCH CONTROL (9 on Figure 3)

This variable resistor adjusts the threshold for the squelch circuit of the receiver. When the control is fully counter-clockwise, the circuit is turned off. Turning the control clockwise activates the circuit and sets the squelch threshold.

AF GAIN, NB PULL-ON CONTROL (10 on Figure 3)

This potentiometer-switch combination adjusts the audio frequency level from the receiver to the speaker. When the knob is pulled out, the noise blanker is turned on to reduce impulse noises.

PHONES JACK (11 on Figure 3)

This 1/4″ phono jack provides a connection for use of 8 ohm headphones with the receiver. The speaker is disconnected when headphones are connected.

FUNCTION SWITCH (12 on Figure 3)

This 6-position rotary switch selects one of the following receiver functions.

STBY — With the switch in this position the receiver is in stand-by — not receiving.

MONI — In this monitor position the T-599A (if the transmitter is connected to the R-599A) generates a low power monitor signal which is used to calibrate the transmitter to the receiver's frequency.

SLOW — This switch position selects a slow receiver AGC (automatic gain control) action for reception of voice signals.

FAST — This switch position selects a fast receiver AGC action for reception of CW signals.

OFF — The receiver's AGC circuit is turned off for receiving very weak signals.

25 kHz — With the switch in this position the receiver's calibrator circuit generates a marker signal at 25 KHz intervals.

MODE SWITCH (13 on Figure 3)

This 6-position rotary switch selects the necessary circuits for receiving the desired mode. When the SELECTIVITY switch is set to AUTO the receiver automatically selects the appropriate filter for reception. The switch positions include CW, LSB, USB, AM (and AM with a noise limiter) and FM.

NOTE

International amateur practice dictates using USB or LSB on the following bands.

1.8 MHz	LSB
3.5 MHz	LSB
7.0 MHz	LSB
14.0 MHz	USB
21.0 MHz	USB
28.0 MHz	USB

S-METER (14 on Figure 3)

The S-meter indicates the level (in db) of the received signal. The meter is calibrated so that a 50 microvolt input signal will produce an S-9 reading on the meter.

SUB-DIAL (15 on Figure 3)

The sub-dial is tuned with the main tuning knob to select the operating frequency of the receiver. It is calibrated at 25 KHz intervals from 0-600 KHz. The operating frequency of the R-599A is determined by adding the frequency shown on the BAND switch, the sub-dial, and the dial scale.

DIAL SCALE (16 on Figure 3)

The dial scale provides a direct frequency readout, calibrated to 1 KHz. The sub-dial is calibrated to display the frequency every 25 KHz. The frequency displayed on the dial scale, when added to the base frequency of the chosen band and the frequency shown on the sub-dial, shows the exact operating frequency of the receiver. One revolution of the dial scale is 100 KHz.

MAIN TUNING KNOB (17 on Figure 3)

This control turns the VFO and dial scale to select the frequency to be added to the band frequency to establish the receiver's operating frequency.

DIAL POINTERS (18 on Figure 3)

These pointers serve as the reference for reading the operating frequency from the dial scale. Choose the correct pointer for the mode used. The side pointers are used for sideband, and the center pointer is used for AM and CW.

VFO LIGHT (19 on Figure 3)

The light illuminates to show which VFO (the transmitter's or receiver's) is controlling operation when the T-599A and R-599A are used together. The lamp lights when the VFO is operating.

3.2 REAR PANEL CONTROLS

HF ANT CONNECTOR (1 on Figure 4)

This SO-239 coax connector should be attached to a suitable antenna for receiving on the desired bands between 1.8 and 29.7 MHz. The receiver is designed for an antenna impedance of 50-75 ohms.

SPEAKER TERMINALS (2 on Figure 4)

These two screw terminals must be connected to an external 4 to 16 ohms speaker.

REMOTE CONNECTOR (3 on Figure 4)

This 16 pin connector controls all of the input, output and switching functions when the R-599A is used with the T-599A. All VFO switching functions are controlled by the R-599A through this connector. The connector also supplies contacts for controlling the receiver with other transmitter (see Figure 2). Table 3 shows functions of each pin.

DC INPUT TERMINALS (4 on Figure 4)

This 2-pin connector is used to connect a 12 VDC power source to the receiver. Negative ground polarity is necessary.

AC/DC SWITCH (5 on Figure 4)

This 2-position slide switch selects AC or DC input to the receiver.

VOLTAGE SELECTOR AND FUSE HOLDER (6 on Figure 4)

This fuse holder switches the R-599A power supply for 100/117/220/240 VAC operation. The fuse is 3AG, 5 amp.

AC POWER CORD (7 on Figure 4)

Use this cord to connect the receiver to an AC power source.

VHF ANTENNA CONNECTORS (8 and 9 on Figure 4)

These SO-239 coax connectors are supplied with the accessory 2 and 6 meter converters. Use the connectors to attach a 50-75 ohm antenna for the appropriate frequencies.

TABLE 3. REMOTE CONNECTOR

PIN	FUNCTION
1.	VFO Input/output during transceive operation.
2.	B+ input from pin 11 (see Figure 2)
3.	Calibrate signal from T-599A during combined operation.
4.	Relay voltage from T-599A during combined operation.
5.	Relay voltage to pin 4 (see Figure 2)
6.	Not used.
7.	Mute control — short to 16 during transmit.
8.	Heterodyne oscillator output to T-599A during transceive operation.
9.	Ground.
10.	Anti-vox output.
11.	B+ output to TX VFO during transceive operation when using the TX VFO for frequency control.
12.	Not used.
13.	Not used.
14.	Not used.
15.	Sidetone input.
16.	Ground.

3.3 INTERNAL CONTROLS

CH SELECT SWITCH

This 6-position rotary switch selects one of the 5 internal fixed channel crystal positions or else the VFO. See Section 4.10 for a full description of the fixed channel feature.

SECTION 4 OPERATION

4.1 BEGINNING PROCEDURE

Be sure to complete all of the required cabling, as described in Section 2.3. Set the operating controls as described in Table 4 below.

TABLE 4. INITIAL SWITCH SETTINGS

CONTROL LOCATION	CONTROL	POSITION
FRONT PANEL	POWER Switch	OFF
	BAND Switch	Desired Band
	RF GAIN Control	Fully Clockwise
	AF GAIN Control	Centered
	MODE Switch	Desired Mode
	FUNCTION Switch	FAST
	PRESELECTOR	Centered
	SELECTIVITY Switch	AUTO
	VFO SELECT Switch	NORM
	SQUELCH Control	Fully Counterclockwise
	NB Switch	OFF
	RIT Switch	OFF
REAR PANEL CONTROLS	DC-AC Switch	Type of Input
	VOLTAGE SELECTOR Switch	Type of Input

4.2 READING THE OPERATING FREQUENCY

The operating frequency of the R-599A is the sum of three different readings — the base frequency of the band (3.5, 7.0, . . .), the reading of the sub-dial (0, 100, 200, . . .) and the reading of the dial scale (0, 10, 20, . . .).

The sub-dial is calibrated in 25 kHz intervals from 0 to 600. The dial scale is calibrated in 1 KHz intervals from 0 to 100. About 4 revolutions of the main tuning knob turns the dial scale one time, covering 100 kHz. Six turns of the dial scale covers the entire band from 0 to 600 KHz.

Example: BAND Switch — 14.0
Sub-dial — Between 200 and 300
Dial Scale — 90
Operating Frequency —
14.0 MHz + 200 KHz + 90 KHz = 14.290 MHz

4.3 CALIBRATION

Turn the FUNCTION switch to 25 KHz to activate the crystal calibrator. Turn the main tuning knob to receive one of the marker signals which are generated at 25 KHz intervals. For greatest accuracy choose a calibrator signal near the desired operating frequency.

LSB

Set the MODE switch to LSB and tune the main tuning knob to zero beat one of the marker signals. If the dial scale reading under the LSB dial pointer is not on an even 25 KHz marking, hold the main tuning knob with one hand and turn the dial scale with the other hand until the dial scale shows the correct reading.

USB

Use the procedure described above with the MODE switch turned to USB. Use the USB dial pointer.

CW, FM, and AM

Turn the MODE switch to CW and use the procedure described above. The center dial pointer should be used as a reference. Tune in the marker signal for a maximum S-meter reading.

4.4 RECEIVER TUNING

Turn the POWER switch on and check that the pilot lamps are lighted. Turn the main tuning knob to receive a signal and adjust the PRESELECTOR to peak the audio volume and S-meter indication. Adjust the AF GAIN control for a comfortable volume.

4.5 NOISE BLANKER

The R-599A has a built-in noise blanker designed to reduce ignition-type impulse noises. When necessary, activate the noise blanker circuit by pulling out the AF GAIN knob.

4.6 AGC (Automatic Gain Control)

Set the FUNCTION switch to the position appropriate for the received signal. Generally for SSB or AM reception, set the FUNCTION switch to SLOW, for CW reception set the FUNCTION switch to FAST, and for reception of a very weak signal the switch may be set to OFF.

4.7 RIT (Receiver Incremental Tuning)

With the RIT switch (on the RF GAIN control) turned off the receiver operates at the frequency shown on the dial scale. To turn the RIT circuit on, push the RF GAIN

knob in. The RIT control then allows tuning of the receiver's frequency about ±2 KHz. This feature is most useful when the R-599A and T-599A are operated together in a transceive configuration. Be careful to turn the RIT feature off when returning to normal operation.

4.8 OPERATION WITH A TRANSMITTER

OPERATION WITH THE T-599A

The REMOTE cord for R-599A — T-599A operation is included with the transmitter. This cord controls all of the input/output, switching, and control features of the two. The VFO switching function of the station is controlled by the receiver's VFO SELECT switch.

The Kenwood twins offer several extra features when used together. The versatile VFO switching allows cross-channel as well as transceive operation, and fixed channel operation. The receiver's calibrator can be used with the transmitter and the transmitter's sidetone output operates through the receiver.

OPERATION WITH ANOTHER TRANSMITTER

Figure 2 shows the necessary REMOTE plug wiring for operation with a non-Kenwood transmitter or transceiver. Pin 7 of the plug controls the receiver's muting and requires a relay contact which is normally closed to ground during transmit. Pin 16 is ground.

4.9 SQUELCH OPERATION

The squelch circuit is designed to remove background noise from the receiver when no signal is being received. Begin with the SQUELCH control turned fully counterclockwise and adjust the AF GAIN control for a comfortable volume. Then turn the SQUELCH control clockwise until the background noise can no longer be heard. Do not adjust the squelch circuit any higher than necessary. Any signal stronger than the adjusted threshold will break the squelch circuit and be heard. To receive weaker signals turn the SQUELCH control counterclockwise.

4.10 FIXED FREQUENCY OPERATION

Inside the R-599A is a printed circuit board which uses a fixed channel oscillator to control the first mixer output. This crystal control permits spot frequency reception (or transmission when used in conjunction with the T-599A) within the band. The fixed channel oscillator has space for 5 channel crystals, one of which can be selected at a time by the CH SELECT switch on the printed circuit board just inside the top cover of the receiver. Therefore, the receiver (and/or the transmitter) can operate at a single crystal controlled frequency in the range to which the BAND switch is turned. The same crystal will have a different frequency on each BAND switch location.

The crystal frequencies for these spot frequencies lie in the range of 4.9 to 5.5 MHz and are determined by an inverse relationship with the receiving frequency as described by the formula below. Trimmers TC1 through TC5 can be used to net the accessory crystals to the exact desired frequency.

During CW, AM, FM Reception

Crystal Frequency = 5.5 MHz + X − The desired Receiving (or transmitter) frequency.

During LSB Reception

Crystal Frequency = 5.5015 MHz + X − The desired Receiving (or transmitter) frequency.

During USB Reception

Crystal Frequency = 5.4985 MHz + X − The desired Receiving (or transmitter) frequency.

X = 1.8 MHz for 160 meters (Receiver only)
X = 3.5 MHz for 80 meters
X = 7.0 MHz for 40 meters
X = 14.0 MHz for 20 meters
X = 21.0 MHz for 15 meters
X = 26.8 MHz for CB
X = 28.0 MHz for 10 meters

When the CH SELECT switch is put in the VFO position the receiver VFO is used instead of the crystals.

Crystal Specifications: Type HC-6/U. Oscillation: Fundamental Frequency. Standard 32 pf loading.

4.11 CHANGING THE BAND COVERAGE

The R-599A is supplied for amateur band use. However, in cases where the owner is willing to sacrifice one or more of the standard frequency ranges, he can substitute an adjacent, special range by changing the appropriate high frequency crystal.

For special frequencies above or below the amateur bands, such as MARS frequencies or others, you can achieve coverage by replacing a crystal, not to be confused with the crystal operation described above. If you are using the T-599A and R-599A together you only have to sacrifice the amateur band on one unit because of the interchangeable VFO switching capabilities.

The only exception to this rule is frequencies near the IF or frequencies above 30 MHz or below 1.8 MHz. These ranges are outside of the basic tuning capabilities of the receiver. If you have the Kenwood twins, you can change the crystal in the receiver for example and retain the standard frequency band in the transmitter. You should remember however, that the farther away from the amateur bands the more out of resonance you become. In receive you lose sensitivity and in transmit you lose power output.

The band crystals for the R-599A are as follows:

BAND	CRYSTAL FREQUENCY
1.8	10.695
3.5	12.395
7.0	15.895
14.0	22.895
21.0	29.895
28.0	36.895
28.5	37.395
29.1	37.995
CB	35.695
10.0	18.895

For example if you replace X 4 by a 15.395 MHz crystal the 40 meter band position will cover 6.5 to 7.0 MHz. You change the band crystal exactly the amount you wish to change the band coverage and in the same direction. Be sure and choose the amateur band closest the operating frequency you wish.

Crystal Specifications: Type HC-18/U.

4.12 WWV RECEPTION

When the R-599A's BAND switch is turned to WWV the receiver should receive WWV at zero on the sub-dial. This is 10.0 MHz.

SECTION 5 PRINCIPLES OF OPERATION

5.1 GENERAL

The Kenwood R-599A is a high frequency SSB, CW, AM or FM solid state receiver that provides full coverage of the amateur bands between 1.8 and 29.7 MHz, the 27 MHz CB band and a WWV signal at 10 MHz. Provisions have been made to extend the coverage of the R-599A to include the 50 and 144 MHz bands by the installation of internally mounted crystal controlled converters available as an optional accessory from your authorized distributor.

The R-599A operates on a double superheterodyne principle for frequencies between 1.8 and 29.7 MHz and the CB band and on the triple superheterodyne principle for 50 and 144 MHz reception. This conversion system effectively increases the signal-to-image ratio and provides greater adjacent channel selectivity.

All boards of the R-599A are marked with their identification numbers which are used not only in the text of this manual, but also in the block and schematic diagrams. A circuit analysis follows. Refer to the block diagram.

5.2 RF BOARD (X44-0020-00)

The signal from the HF antenna, or the 6 and 2 meter converters, is sampled by a pair of back-to-back germanium diodes. Any signal applied to these diodes will be limited to a maximum of 400 mv peak-to-peak. This protects the receiver from front-end overload caused by high power transmitters operating in close proximity.

The output of the peak limiting diodes is applied to the RF amplifier Q1, an FET. Because of the better cross modulation characteristics, and higher input and output impedance, the FET is particularly suitable for use as a high gain RF amplifier.

The antenna and RF coil packs associated with RF amplifier Q1 are composed of individually tuned circuits for each of the amateur bands. The appropriate tuned circuit for the band in use is automatically selected by turning the BAND switch to the desired band of operation.

Because of the high input and output impedance of RF amplifier Q1, loading of the tuned circuits is substantially reduced, effectively increasing their Q providing high selectivity on all bands.

The amplifier RF signal between 1.8 and 29.7 MHz is coupled through the selected RF coil to gate 1 of 1st mixer Q2. The output of heterodyne crystal oscillator Q3, a third overtone crystal oscillator, is applied to gate 2.

The output of the mixer is a wideband RF signal consisting of the sum, difference, and the two original input signals.

The output of the heterodyne oscillator, Q3, is also coupled through buffer transistor Q4 to the remote terminal of the receiver. Subsequently the output is used as the 2nd mixer injection signal for the T-599A when the transmitter is used in a combined transmitter/receiver configuration.

5.3 IF BOARD (X48-0011-00)

The wide-band RF signal from the 1st mixer is coupled to the IF board through the band-pass filter (BPF). The BPF has a pass-band of 600 KHz (8.295 to 8.895 MHz) and therefore always selects the difference component of the input signal.

The 1st IF signal, a 600 KHz spectrum between 8.295 and 8.895 MHz, is applied to 2nd mixer Q1, a subtractive mixer, where it is heterodyned with the 4.9 to 5.5 MHz output of the variable frequency oscillator (VFO). This produces the 2nd IF of 3.395 MHz. This signal is then fed to the noise blanker circuit which reduces impulse noise from the received signal. The circuit is controlled by the NB switch on the panel. The output of the noise blanker circuit enters the filter board which contains the SSB, CW, AM and FM filters. The appropriate filter is selected automatically or manually depending the mode of operation in use.

The 2nd IF output of the selected filter is applied to a two stage IF amplifier (comprised of integrated circuit Q2, TA7045M and transistor Q3) where IF amplification is accomplished. The output of the 2nd IF amplfier, Q3, is connected to one of three types of detector circuits, depending on the mode of operation selected. These include a ring detector (composed of diodes D4-D7 for SSB and CW operation), a ratio detector (composed of limiter Q8 and transformer T8), and diodes D9-D10 for FM detection.

Part of the 2nd IF signal from amplifier Q3 is coupled through capacitor C13 to an AGC circuit, consisting of diodes D1 and D2. The detected output is applied to AGC amplifier Q4, where it is amplified and applied to transistor Q5, a current amplifier and emitter follower.

Transistor Q5 delivers two outputs. The low impedance output from the emitter is applied to the 1st IF amplifier IC Q2, the 2nd IF amplifier (Q3) RF amplifier Q1, and the squelch amplifier, Q6.

The collector of Q5 is returned to ground through the S-meter and therefore causes the S-meter to deflect in direct proportion to the AGC voltage developed. This provides an accurate measurement of the input signal level when used in conjunction with the step attenuator.

The attack and release time of the AGC circuit is determined by the collector-to-emitter resistance of transistor Q4 and series capacitors C3 and C4. With no signal input to 2nd IF amplifier Q3, AGC amplifier capacitors C3 and C4 have charged through the collector resistor of Q4 to the 9 volt source voltage. Application of a signal to 2nd IF amplifier Q3 causes AGC output, which biases Q4. Application of the forward bias causes Q4 to go into hard conduction, lowering its collector-to-emitter resistance to approximately 33 ohms, allowing capacitors C3 and C4 to discharge very quickly. The discharge of these capacitors forward biases AGC output transistor Q5 causing it to go into conduction which applies an AGC voltage to the RF amplifier, IF amplifier and 2nd mixer circuits. Removal of the input signal from the 2nd IF amplifier,

Q3, removes the forward bias from AGC amplifier, Q4 causing it to go into cutoff. Under these conditions, C3 and C4 provide ideal fast-attack slow-release AGC characteristics. Positioning the AGC selector switch in the slow position shorts out capacitor C4 which increases the total circuit capacity, increasing the attack/release time.

The output of AGC transistor Q5 is coupled through resistor R23 to the base of squelch amplifier Q6, where it is amplified and applied to the base of buffer transistor Q7. This controls the base voltage of Q7 with the input signal. As a result, buffer transistor Q7 controls AF amplifier Q1 (in the AF unit) with its output, performing a squelch operation under control of the input signal. The squelch threshold is set by a front panel SQUELCH control.

5.4 NOISE BLANKER BOARD (X54-1080-10)

This circuit is designed to reduce impulse noise from the received signal. The noise blanker consists of an IF amplifier, a noise amplifier, and a switching gate which turns the signal path on and off as controlled by the noise impulses. The 2nd IF signal (3.395 MHz) passes through the band-pass filter (composed of T1, T2, and T3). The 2nd IF signal is produced by the 2nd mixer. If then feeds to gate 2 of IF amplifier Q1 and the gate of noise amplifier Q2. Q1 compensates for the internal loss of the NB circuit to insure an overall gain of approximately 0 db within the noise blanker.

Transistor Q2 operates as a source follower to transfer the signal to IC Q3 (TA7045M). Transistors Q2, Q3, and Q4 form a noise amplifier whose output is rectified by diodes D5 and D6 and fed to switching transistor Q5. At the input of Q5, the signal is also fed to transistor Q6.

Transistor Q6, an AGC amplifier, is designed to reduce the gain of Q3 and Q4 when the signal is continuous and, when the signal is pulsating, maintain gain. This design permits separation of noise components from the signal. When noise is applied to transistor Q5, it switches the noise gate (composed of diodes D1 through D4) open and closed to eliminate noise components from the signal.

The noise blanker is activated by pulling the front panel AF GAIN knob out. The switch grounds the emitter of Q5 to the chassis.

5.5 FILTER BOARD (X51-1050-10)

This board incorporates different filters for the SSB, CW, AM and FM modes of operation. The appropriate filter is selected by a diode switch when the MODE switch is set to the desired type of operation.

With the MODE switch set to the SSB position, 13.8 VDC is applied to the SSB terminal of XF1. This forward biases diodes D1-D2 and reverse biases diodes D3 through D14. Under these conditions only the CW signal is passed through filter XF1, from the noise blanker to the 1st IF amplifier Q2. The reverse biased diodes D3 through D14 provide 110 db isolation to the unselected filters.

5.6 VFO CIRCUIT (X40-0016-08)

The Variable Frequency Oscillator operates in the frequency range of 4.9 to 5.5 MHz. The circuit is composed of a field effect transistor (FET) operating in a Clapp configuration followed by three buffer stages, each employing FET's.

The output from the 1st buffer stage is coupled through a harmonic filter to the output stage, consisting of two FET's connected in a Darlington configuration and acting as a low impedance buffer.

The VFO also uses a Receiver Incremental Tuning (RIT) circuit, operated by the RIT voltage developed in the automatic voltage regulator board (X43-0010-00).

The RIT circuit is activated by the receiver relay and varies the receive VFO frequency regardless of the setting of the VFO SELECT dial. The RIT control is located on the front panel.

The transceiver's VFO is enclosed and completely adjusted. IT SHOULD NEVER BE REMOVED FROM ITS CASE OR MODIFIED IN ANY WAY.

5.7 CARRIER BFO BOARD (X50-0002-00)

The BFO circuit is a crystal controlled oscillator operating in a Pierce configuration. Fine adjustment of the output frequency is accomplished by trimmer capacitors TC1 through TC3 which are connected in parallel with crystals X1, X2, and X3 respectively. The appropriate crystal for the USB, LSB, or CW mode of operation is selected by a diode switch.

When the MODE switch is placed in the LSB position, +13.8 VDC is applied to the LSB terminal of the BFO board. This applies a forward bias through resistor R4 and inductor L4 to diode D4, turning it on. With diode D4 turned on, capacitor C6 is grounded through the low forward resistance of the diode, allowing transistor Q1 to go into oscillation at the crystal frequency of X3 (3393.5 KHz).

When operating in the USB mode, the BFO operates as previously described except the +13.8 VDC is applied to diode D3 (through resistor R3 and inductor L3) thereby selecting crystal X2.

When the MODE switch is placed in the CW position, +13.8 VDC is applied to the CWR terminal of the BFO board. This applied voltage forward biases diode D1, having gone through resistor R1 and inductor L1. Diode D1 is thus turned on. This grounds crystal X2 through diode D1, without a series capacitor. As a result, oscillator Q2 oscillates at a frequency approximately 700 Hz lower than the crystal frequency. The beat frequency of the received signal may be varied ±200 Hz by trimmer capacitor TC1.

The output of oscillator transistor Q1 is applied to the base of buffer Q2 through a voltage divider composed of C10 and C13. Buffer transistor Q2, connected in an emitter-follower configuration, provides an output impedance of 100 ohms, minimizing frequency variation due to changes in the load.

5.8 MARKER BOARD (X52-0005-01)

The marker circuit provides a calibrating signal at 25 KHz intervals over the range 3.5 to 29.0 MHz. The calibration circuit is activated by setting the FUNCTION switch to the 25 KHz CAL position.

Transistor Q1 and crystal X1 form a 100 KHz oscillator.

Trimmer capacitor TC1, in the collector circuit of Q1, provides a means for precision adjustment of the oscillator frequency.

5.9 AUTOMATIC VOLTAGE REGULATOR (AVR) BOARD (X43-0010-00)

The AVR circuit supplies power to the VFO, carrier oscillator, heterodyne oscillator, and other circuits of the transmitter that require a stable low voltage source. Precision regulation of the +9 volt supply is obtained by the use of an error amplifier and transistor series regulator. Detailed circuit analysis is as follows:

Transistors Q3 and Q4 comprise a differential amplifier. Transistor Q2 is the error amplifier and transistor Q1 is the series regulator. The reference voltage for the differential amplifier is established by resistor R9 and D1, a 6.6 volt zener diode. The emitter voltage of Q4 follows its base voltage (less the base-emitter drop of approximately .6 volts) and places the emitter of Q3 approximately .2 volts negative with respect to the base. Under these conditions error amplifier Q2 and series regulator Q1 are quiescent and the output voltage is stabilized at +9 volts.

Should the output voltage (sensed at the base of transistor Q3) decrease, the collector current will also decrease causing increasing collector voltage. The increase in Q3 collector voltage is directly coupled to the base of error amplifier Q2; this increasing positive potential on the base causes the collector current to increase, decreasing the collector voltage. The decrease in collector voltage of Q2 is felt on the base of series regulator Q1, a silicon PNP transistor. The decrease in base voltage causes an increase in current through Q1 decreasing the collector-to-emitter voltage drop, stabilizing the output voltage at +9 volts.

5.10 AF BOARD (X49-1040-10)

The AF signal from squelch buffer transistor Q7 is coupled through audio gain control VR4 and capacitor C1 to the base of amplifier Q1. The output of Q1 is further amplified by Q2 and applied to a power amplifier consisting of Q3 and Q4. Transistors Q3 and Q4 are connected in a complimentary configuration and form an output transformerless (OTL) circuit. Negative feedback is coupled from the common emitter connection of Q3 and Q4 to 2nd amplifier Q2. This lowers the impedance of the output circuit and decreases overall distortion.

Variable resistor VR1 is used to adjust the side-tone volume in the CW mode. A diode switch, D1, is inserted to cut off the high part of the AF spectrum of CW signals. The diode is biased in the forward direction to activate capacitors C4 and C5 to filter the signal.

5.11 FIXED CHANNEL BOARD (X50-1140-10)

This unit consists of transistor Q1 connected in a Pierce oscillator configuration and emitter follower transistor Q2 acting as a low impedance buffer.

Oscillator transistor Q1 operates in conjunction with a fixed channel crystal selected by the CH SELECT switch. Provisions have been made for up to five crystals.

The output of oscillator transistor Q1 is coupled through emitter follower Q2 to 2nd mixer Q2, where it is heterodyned with the input from the band-pass filter to produce the desired fixed frequency of reception.

The fixed channel board holds the VFO indicator lamp circuit. The DC 9 volt supply, for the VFO, is applied to the base of transistor Q4 through resistor R8 (10 K ohms) to conduct the transistor which lights the VFO indicator lamp.

On the fixed channel unit, jacks J1 and J2 are for connection to the 6 and 2 meter crystal converters. If one of these converters is to be used, connect it to the R-599A with the 7-prong plug.

5.12 OPTIONAL ACCESSORIES

50 MHZ CONVERTER

The 50 MHz crystal controlled converter consists of an RF amplifier, mixer, and two local oscillators.

The signal from the VHF antenna in the frequency range of 50 to 51.7 MHz (for channel A) or 51.7 to 53.4 MHz (for channel B) is coupled through the antenna input circuitry to FET RF amplifier Q1. The output of Q1 is applied to FET mixer Q2 where it is heterodyned with the 22 MHz output of local oscillator Q3 for channel A reception. The output is heterodyned with the 23.7 MHz output of local oscillator Q4 for channel B reception in the 51.7 to 53.7 MHz frequency range.

The difference frequency in the range of 28.0 to 29.7 MHz is then coupled to the RF unit of the R-599A receiver.

A protective circuit composed of diodes D1-D2 is inserted in the antenna input circuit of this unit to prevent punch through of the FET RF amplifier. AGC voltage from the R-599A AGC unit is applied to the RF amplifier Q1 and and mixer Q2 to prevent overload and subsequent distortion due to a high level input signal. Precise tuning of the RF and mixer tuned circuits is accomplished using a capacity variable diode connected in parallel with each tuned circuit.

144 MHZ CONVERTER

The 144 MHz crystal conrtolled converter consists of RF amplifier Q1, mixer Q2, local oscillator Q3 and Q4, and tripler Q5.

The input signal from the VHF antenna in the frequency range of 144 to 145.7 MHz (for channel A) or from 145.7 to 147.4 MHz (for channel B) is coupled through the antenna input circuits to RF amplifier Q1. The output of Q1 is applied to mixer Q2, where it is heterodyned with the 116 MHz output of tripler Q3 to produce a difference IF of 28.0 to 29.7 MHz for channel A recepion. Or it is heterodyned with the 117.7 MHz output of tripler Q3 to produce a difference IF of 28.0 to 29.7 MHz for channel B reception. The 28.0 to 29.7 MHz IF signal is then applied to the RF amplifier of the R-599A receiver.

A protective circuit (composed to diodes D1 and D2) is inserted in the antenna input circuit of this unit to prevent punch through of the field effect transistor RF amplifier. AGC voltage from the R-599A AGC unit is applied to the RF amplifier Q1 and mixer Q2 to prevent overload and subsequent distortion due to a high level input signal. Precise tuning of the RF and mixer tuned circuits is accomplished using a capacity variable diode connected in parallel with each tuned circuit.

SECTION 6 MAINTENANCE

6.1 REMOVAL OF CABINET AND BOTTOM PLATE

Remove two screws on the top rear of the cabinet, then remove six screws from the sides and remove the cabinet.

6.2 VFO DRIVE GEARS

Thoroughly clean and lubricate the drive gears of the VFO once each year with machine oil.

6.3 PILOT LAMPS

Should the pilot lamps require replacement be sure and replace them with an identical lamp with a rating of 14 volts at 200 ma.

6.4 ALIGNMENT OF THE MARKER OSCILLATOR (X52-0005-01)

Should the marker oscillator require adjustment, refer to Figure 8 and proceed as follows: Set up the receiver to receive WWV at 10 MHz. Adjust TC1 on the marker board (X52-0005-01) for zero beat as heard on the receiver speaker.

6.5 AUTOMATIC VOLTAGE REGULATOR UNIT (AVR) (X43-0010-00)

Should the AVR unit require adjustment refer to Chassis Bottom View and proceed as follows: Monitor the +9 VDC output on terminal board (X43-0010-00) with a high impedance VTVM. Adjust VF1 until the output reads +9 volts.

To adjust RIT voltage, precisely set the RIT control to zero. Tune in the 25 KHz marker signal, and while turning the RIT on and off, adjust VR2 until the same beat note is heard with the RIT on as with it off.

6.6 AF UNIT (X49-1040-10)

Adjustment of the level of sidetone output in the CW mode is made with variable resistor VR1 inside the AF unit.

6.7 S-METER ADJUSTMENT

S-METER ZERO

There is no electrical S-meter zero adjustment. If the meter does not read zero when the receiver is turned off, zero the meter movement with the adjusting screw on the meter. If the S-meter does not read zero after it has been mechanically zeroed, check Q5 on the IF board.

S-METER SENSITIVITY

If the S-meter requires recalibration, tune the receiver to about 14.250 MHz and apply 50 μv to the antenna terminal. Adjust the PRESELECTOR control to peak the S-meter reading and then adjust VR1 on the RF board for a reading of S-9 on the meter.

6.8 RIT ZERO

When the receiver's RIT circuit is turned on and the RIT control is set to zero, the R-599A should receive at exactly the same frequency as when the circuit is turned off. If the RIT zero requires adjustment, turn the receiver on, turn the RIT circuit on and set the RIT control to "0". Turn on the calibrator and receive one of the marker signals at a comfortable tone (on any band). Turn the RIT circuit off and adjust VR2 on the AVR board until the receiver is receiving the same tone.

6.9 RECEIVER ALIGNMENT

Tune the receiver to receive a marker signal from the calibrator at 2.050 MHz. Set the PRESELECTOR to a 12 o'clock position (pointing straight towards the top of the front panel) and adjust in turn the antenna, the RF and the oscillator coils for the 1.8 MHz band for a maximum S-meter reading. Repeat this procedure for each band at 3.750 MHz, 7.250 MHz, 14.250 MHz, 21.250 MHz, 28.750 MHz, 27.100 MHz and 10.250 MHz. Be careful to tune the correct coils for each band. Always adjust the antenna coil, then the RF coil, and then the oscillator coil.

6.10 FUSE REPLACEMENT

There is always some cause when the fuse blows. Be sure to find the cause before attempting operation. Under no circumstances use a higher amperage fuse than the one specified. Extensive damage can be caused by an improper fuse. Also the warranty can be voided if an improper fuse is used.

6.11 ORDERING SPARE PARTS

When ordering replacement or spare parts for your equipment, be sure to specify the following information:

Model number and serial number of the equipment — Schematic number of the part — and the board number on which the part is located.

Should it ever be necessary to return the equipment for repair, be sure to pack it very carefully (preferably in its original box and packing), and return it prepaid. Also include a full description of the problems involved.

* * * * * * * * *

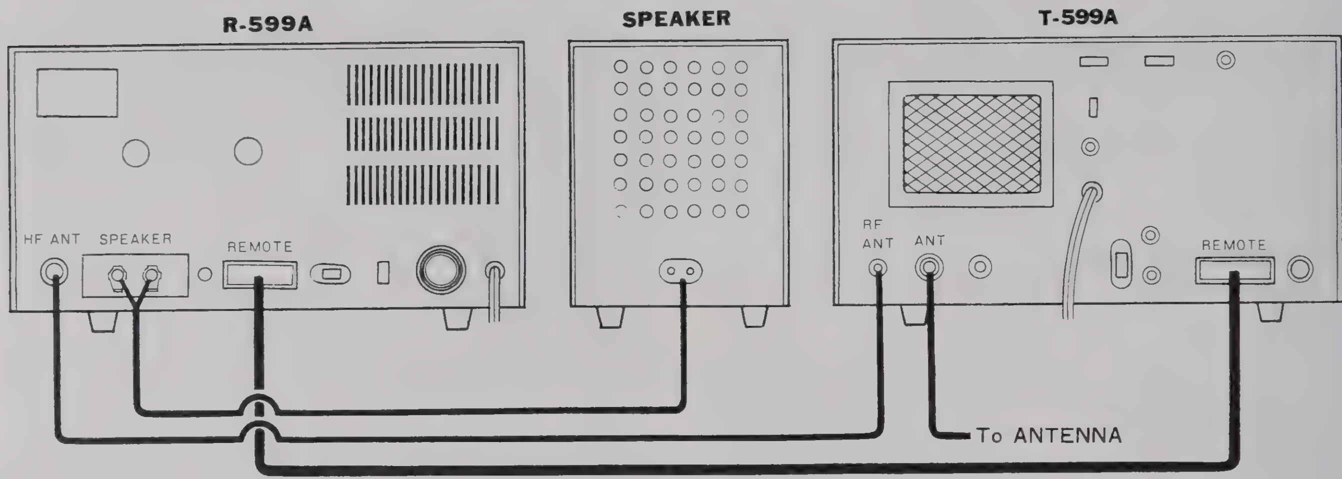
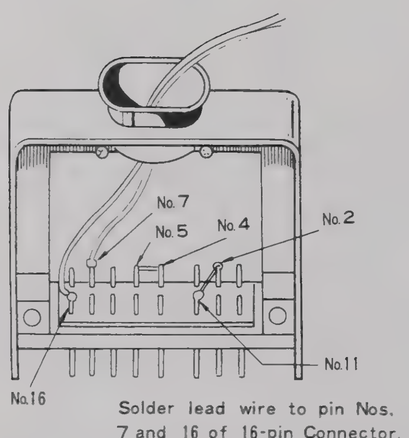
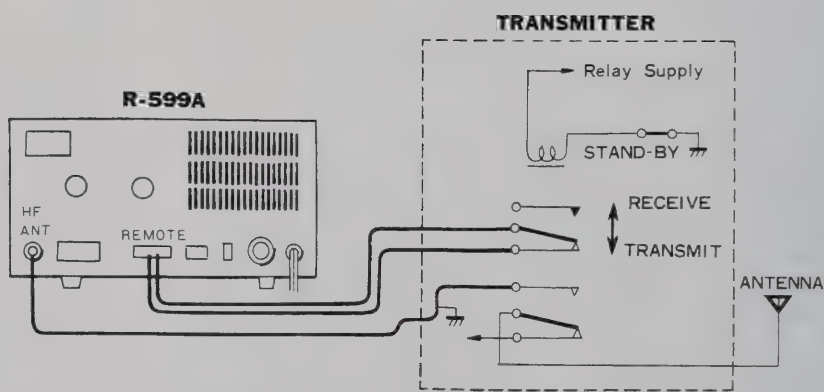


Fig. 1 Connection Diagram for R-599A and T-599A



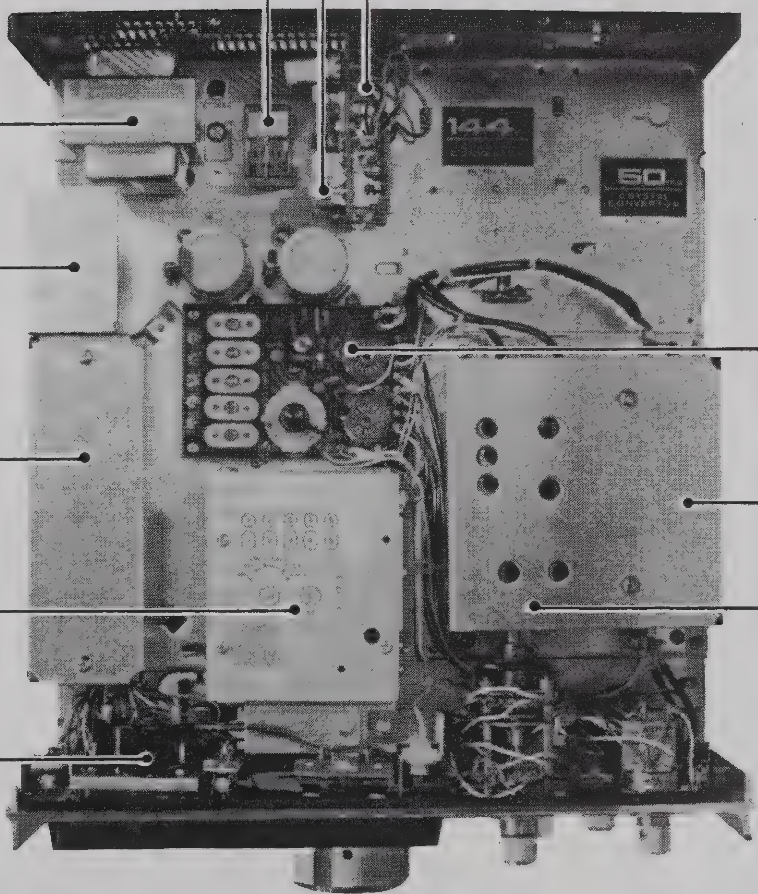
(a) Connection Diagram of Socket



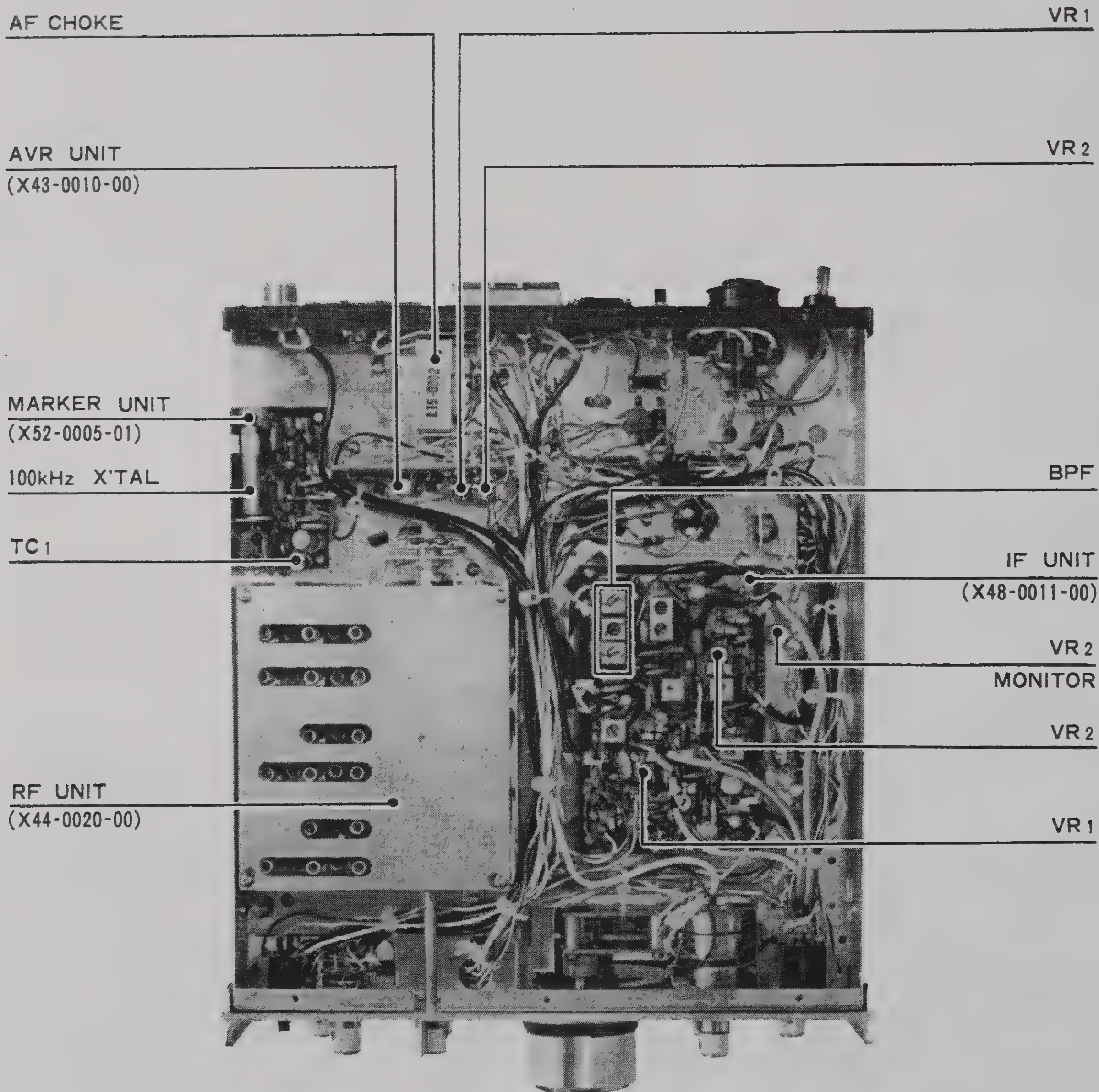
(b) Connection of Transmitter

Fig. 2 Connection Diagram for R-599A and another Transmitter

CHASSIS TOP VIEW



CHASSIS BOTTOM VIEW



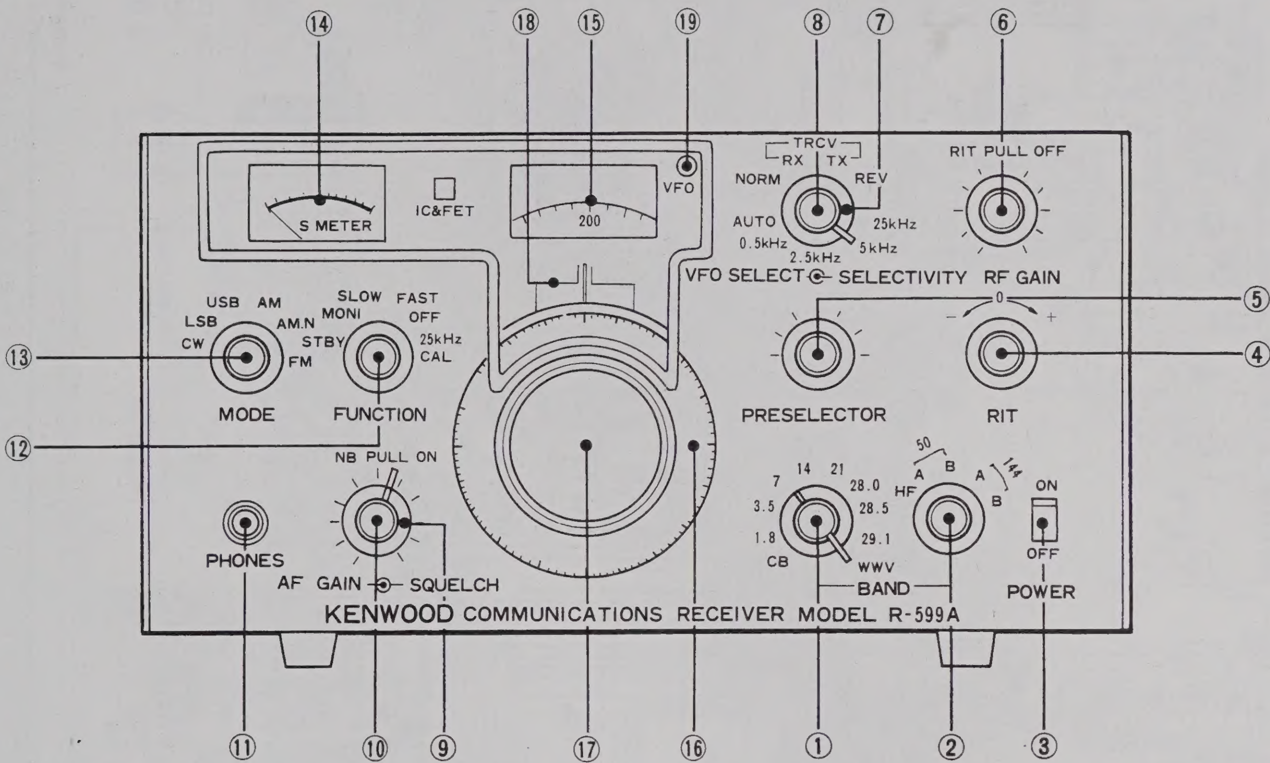


Fig. 3 Front Panel

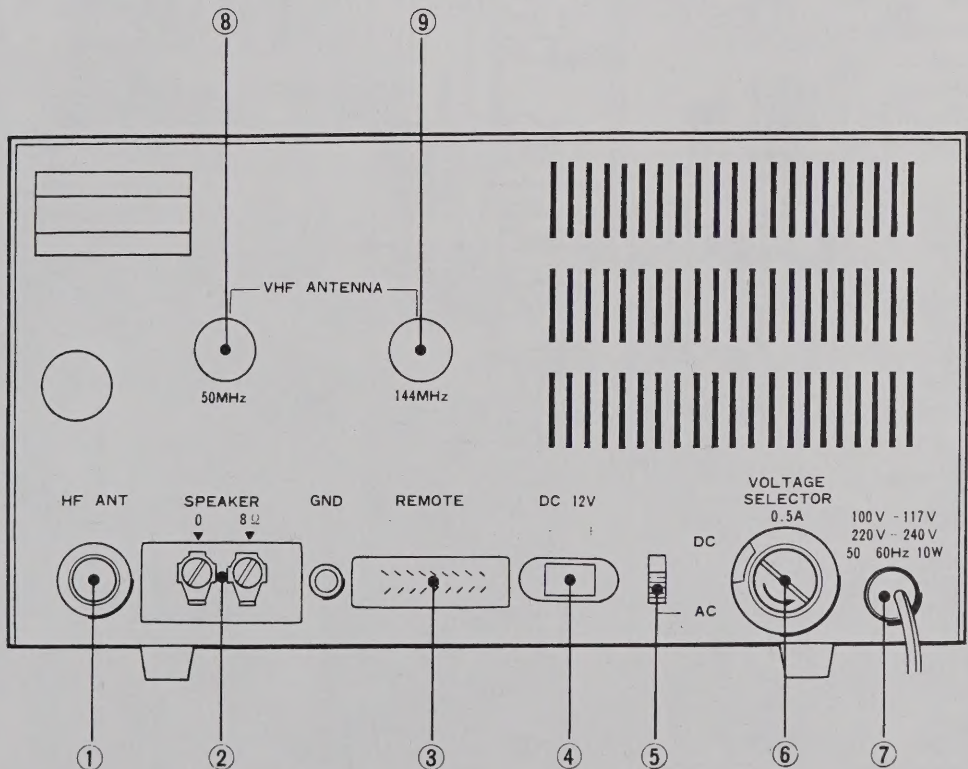
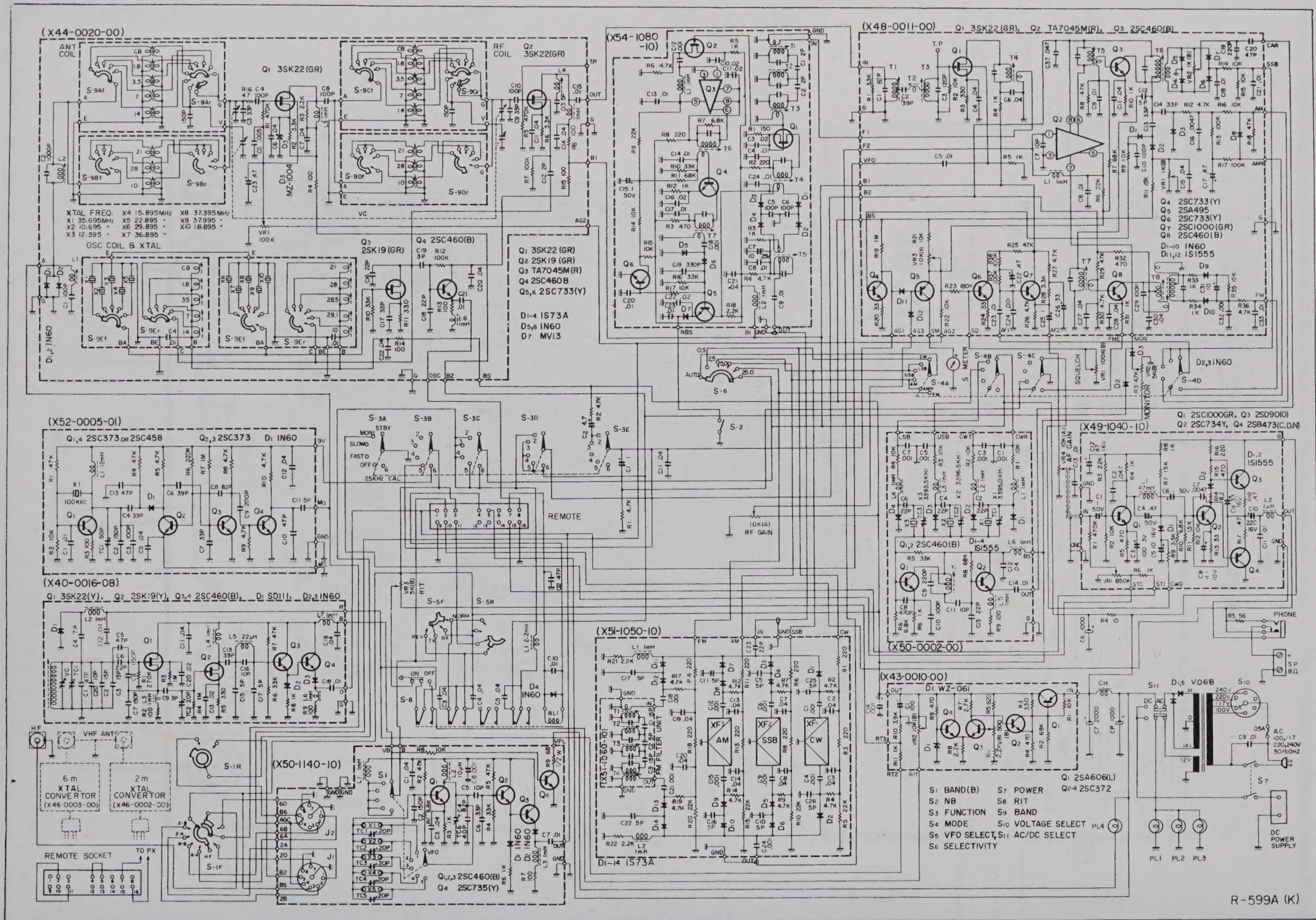


Fig. 4 Rear Panel

SCHEMATIC DIAGRAM



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